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## NOTICE OF ALLOWANCE AND FEE(S) DUE

23416 7590 02/03/2010

CONNOLLY BOVE LODGE & HUTZ, LLP  
P O BOX 2207  
WILMINGTON, DE 19899

EXAMINER

HU, HENRY S

ART UNIT

PAPER NUMBER

1796

DATE MAILED: 02/03/2010

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/522,839

06/06/2005

Joachim Kiefer

15588-00007-US

4211

TITLE OF INVENTION: PROTON-CONDUCTING POLYMER MEMBRANE COMPRISING POLYMERS CONTAINING PHOSPHONIC ACID GROUPS AND ITS USE IN FUEL CELLS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1510	\$300	\$0	\$1810	05/03/2010

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

### HOW TO REPLY TO THIS NOTICE:

#### I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**

# **PART B - FEE(S) TRANSMITTAL**

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE  
Commissioner for Patents  
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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23416 7590 02/03/2010

**CONNOLLY BOVE LODGE & HUTZ, LLP  
P O BOX 2207  
WILMINGTON, DE 19899**

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## **Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/522,839 06/06/2005 Joachim Kiefer 15588-00007-US 4211

**TITLE OF INVENTION: PROTON-CONDUCTING POLYMER MEMBRANE COMPRISING POLYMERS CONTAINING PHOSPHONIC ACID GROUPS AND ITS USE IN FUEL CELLS**

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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nonprovisional NO \$1510 \$300 \$0 \$1810 05/03/2010

EXAMINER	ART UNIT	CLASS-SUBCLASS
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HU, HENRY S 1796 521-027000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 \_\_\_\_\_
- (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 \_\_\_\_\_
- 3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s); (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature \_\_\_\_\_

Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_

Registration No. \_\_\_\_\_

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/522,839	06/06/2005	Joachim Kiefer	15588-00007-US	4211
23416	7590	02/03/2010	EXAMINER	
CONNOLLY BOVE LODGE & HUTZ, LLP P O BOX 2207 WILMINGTON, DE 19899			HU, HENRY S	
			ART UNIT	PAPER NUMBER
			1796	
DATE MAILED: 02/03/2010				

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 962 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 962 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

<b>Notice of Allowability</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/522,839	KIEFER ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	HENRY S. HU	1796	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Amendment of November 18, 2009.
2. ☒ The allowed claim(s) is/are 1-16, 19, 21 and 23-30.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☒ All    b) ☐ Some\*    c) ☐ None    of the:
    1. ☒ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
  - \* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
  - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
    - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
  - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)</li> <li>2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)</li> <li>3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br/>Paper No./Mail Date _____</li> <li>4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br/>of Biological Material</li> </ol> | <ol style="list-style-type: none"> <li>5. <input type="checkbox"/> Notice of Informal Patent Application</li> <li>6. <input type="checkbox"/> Interview Summary (PTO-413),<br/>Paper No./Mail Date _____.</li> <li>7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment</li> <li>8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance</li> <li>9. <input type="checkbox"/> Other _____.</li> </ol> |
|--|---|

### EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with **Attorney Ashley I. Pezzner** (reg. # 35,646, tel. 302 658-9141) on **January 26, 2010** to cancel non-elected Claim 22 as following:

#### Claim

**Claim 22**     please cancel Claim 22

### DETAILED ACTION

2. This Office Action is in response to **two** things including **Amendment and Declaration** (written by Dr. Thomas Schmidt) both filed on November 18, 2009, which are in response to non-final office action of July 23, 2009. With such an amendment, **Claim 1 is amended; non-elected Claims 17-18 (Group II) and Claim 20 (Group III) are cancelled, while new Claims 24-30 are added.** To be specific, parent **Claim 1** is now "once-amended" in at least **three**

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ways including: (A) **at least 20% by weight** (based on the total weight) of vinyl-containing phosphonic acid is used for mixing, (B) the final membrane has a **proton conductivity of at least 0.001 S/cm @ 120 °C**, and (C) the improper language “obtainable” is change to “obtained” so as to overcome 112-2<sup>nd</sup> claim rejection.

The use of above-mentioned Examiner’s Amendment is only to cancel non-elected Claim 22 (Group IV). Applicants have also cancelled non-elected Claims 17-18 and 20. After further consideration, **non-elected Claims 19 and 21 are rejoined by Examiner to be with elected Group I.** Applicants have filed **three IDS** (1 page each) so far. **Claims 1-16, 19, 21 and 23-30 with only one independent claim (Claim 1) are now pending.** An action follows.

3. Claim rejections under **Non-Final** Office Action filed on August 18, 2009 are now removed for the reasons given in paragraphs 4-13 thereafter.

***Allowable Subject Matter***

4. Claims 1-16, 19, 21 and 23-30 are allowed.

5. The following is an examiner's statement of reasons for allowance: The above Claims 1-16, 19, 21 and 23-30 are allowed over the closest references:

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6. The limitation of “**once-amended**” parent **Claim 1** in present invention relates to a proton-conducting polymer membrane comprising polymers containing phosphonic acid groups which is obtained by a process comprising four steps:

(A) mixing at least 20% by weight of based on the total weight of the mixture of vinyl-containing phosphonic acid with one or more aromatic tetraamino compounds with one or more aromatic carboxylic acids, esters thereof, acid halides thereof or anhydrides thereof which contain at least two acid groups per carboxylic acid monomer, and/or mixing of vinyl-containing phosphonic acid with one or more aromatic and/or heteroaromatic diamino carboxylic acids, esters thereof, acid halides thereof or anhydrides thereof,

(B) heating of the mixture obtainable according to step (A) under inert gas at temperatures of up to 350 °C to form a polyazole polymer,

(C) application of a layer using the mixture from step (A) and/or (B) to a support,

(D) polymerization of the vinyl-containing phosphonic acid present in the sheet-like structure obtainable according to step (C)

and wherein the membrane has a proton conductivity of at least 0.001 S/cm @ 120 °C.

See other limitations of dependent **Claims 2-16, 19, 21 and 23-30.**

7. Parent **Claim 1** (now once amended) relates to **a proton-conducting polymer membrane** in the form as IPN network structure according to the art. Said “IPN” membrane is useful for polymer electrolyte fuel cells (see title). A four-step process makes it. To be specific, the proton-conducting polymer membrane is obtained from **four** sequential steps

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including: (A) mixing the precursor (for making polyazole type polymer) with vinyl-containing phosphonic acid, (B) heating the mixture from (A) to obtain polyazole type polymer, (C) applying of a layer using the mixture from (A) or (B) to a support, and (D) polymerizing the vinyl-containing phosphonic acid present in the sheet-like structure. Phosphonic acid-containing monomer in the specified amount of at least 20 % by weight (based on the total weight) is now mixed with other precursors so as to first make a polyazole polymer in the form as sheet-like structure, and the step of polymerizing vinyl-containing phosphonic acid within the chains of polyazole. With current amendment, the final membrane has a **proton conductivity of at least 0.001 S/cm @ 120 °C**. Open language “**comprising**” is applied to the process of parent Claim 1.

8. **103(a) rejection** relying on the sole primary reference **Suzuki** in view of **two** secondary references including **Kreuer and Sakaguchi** cannot stand as follows: As discussed earlier, **Suzuki** has already disclosed the preparation of a **high-durability solid polymer electrolyte membrane** to be in the particular form as **interpenetrated polymer network** (IPN) structure so as to be useful for fuel cell application. Suzuki’s process example can be particularly shown on **Figure 9** by **polymerization and/or crosslinking a monomer (such as vinylphosphonic acid) within the polymeric (such as polyether sulfone (PES) or polyether ether ketone (PEEK)) chains** so as to form IPN structure.

9. In a very close examination, instant parent Claim 1 requires the polymerizable monomers and precursors to be mixed together prior to any polymerization. For instance, vinyl-

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containing phosphonic acid monomer is pre-mixed with precursors to prepare the polyazole polymer. This polymerization environment is certainly and at least somewhat different from Suzuki's mixing system, wherein vinyl-containing phosphonic acid monomer is mixed with a real polymer, not a precursor or a precursor mixture (able to be polymerized to become polymer). As a matter of fact, the existence of vinyl-containing phosphonic acid monomer may play some role in the course of polyazole polymer formation. Therefore, the eventual polymeric mixtures in both cases will behave at least somewhat different from each other.

10. **Two** references including **Kreuer and Sakaguchi even in combination still cannot fix the deficiency from Suzuki**, particularly on the pre-mixing of vinyl-containing phosphonic acid monomer with the precursors (of forming a polyazole polymer). For one instance, **Kreuer** only discloses that proton conductors can be prepared by comprising **two** components including: (A) **high molecular weight polymeric acid including phosphonic acid ( $-\text{PO}^3\text{H}$ )**, and (B) **amphoteric polymeric material such as polyazole type polymer**. For the other instance, **Sakaguchi** only discloses that **polyazole type polymer can be readily prepared by directly heating from the claimed precursor mixtures** including: (A) amine compound and (B) carboxylic acid compound.

11. In order to be totally distinguished over the prior reference for such **103(a) rejection**, Applicants have now amended parent Claim 1 with **two** conditions including: (A) **at least 20% by weight** (based on the total weight) of vinyl-containing phosphonic acid monomer is used for

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mixing with the precursor of polyazole polymer, (B) the final membrane has a **proton conductivity of at least 0.001 S/cm @ 120 °C**. Attention is directed to the fact that Suzuki only uses about 7 wt% of vinyl-containing phosphonic acid monomer. Therefore, all the above-mentioned references, in combination or alone, does not teach or fairly suggest the product by process limitation of present invention.

12. After further examination and search, the examiner found the following prior art did not teach the claimed limitation: **US 2007/0292734 A1 to Kiefer** et al. only discloses a process for producing a proton conducting electrolyte membrane for fuel cell application. It is only achieved by **irradiating a polymer film and then “graft”-polymerized a vinylphosphonic acid monomer**. See abstract, line 1-5; Claim 1 at page 16. **Vinyl-containing phosphonic acid is not polymerized within the chains of polyazole**. Particularly, **the pre-mixing of vinyl-containing phosphonic acid monomer with the precursors (of forming a polyazole polymer) is not disclosed or suggested**. The IPN network structure is certainly not included. Therefore, Kiefer cannot teach or suggest the limitation of parent Claim 1.

13. As of the date of this office action, the examiner has not located or identified any reference that can be used singularly or in combination with another reference including the above references to render the present invention anticipated or obvious to one of the ordinary skill in the art. Therefore, the independent product by process **Claim 1** is allowed for the reason

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listed above. Since the prior art of record fails to teach the present invention, the remaining pending dependent **Claims 2-16, 19, 21 and 23-30** are passed to issue.

14. Any inquiry concerning this communication or earlier communication from the examiner should be directed to **Dr. Henry S. Hu whose telephone number is (571) 272-1103**. The examiner can be reached on Monday through Friday from 9:00 AM –5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dr. Vasu Jagannathan, can be reached on (571) 272-1119. The **fax** number for the organization where this application or proceeding is assigned is **(571) 273-8300** for all regular communications. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Peter D. Mulcahy/  
Primary Examiner, Art Unit 1796

/Henry S. Hu/  
Examiner, Art Unit 1796

January 30, 2010